ON RESEARCH STYLES AND ALLIED MATTERS

S. E. Luria
Department of Biology
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Version Received Oct 24, 1972

To evaluate various situations as more or less conducive to scholarship and research one must first define criteria for judgment, that is, a relevant value system. This is a complex task involving many considerations external to research itself. Thus a dictatorship may provide superior opportunities for applying the products of basic research to practical purposes or larger audiences to approved works of scholarship; but at the same time it is generally counterproductive to the generation of truly basic research and scholarship. An industrial laboratory or an American university may provide superior opportunities for research productivity and yet, for a variety of reasons, may dissociate the products of research from meaningful applications. As in all matters in which contrasting principles are at play, the answer to the question: 'What are optimal conditions for research?' must ultimately be some compromise, more or less well camouflaged as wisdom -- unless one chooses to give no answer at all.

What this article attempts to do is to assemble some thoughts on the interplay between researchers and their environment from the limited point of view of what might be called research style, and to draw some conclusions concerning opportunities, pitfalls, and responsibilities that face the researchers -- be they scholars or scientists -- depending at least in part on their style of research performance.

Style in research, that is, the way X or Y or a set of Z individuals does it, reflects all sort of variables: the subject matter; the personality of the practitioner, subject to change under a variety of

influences; the institutional settings, all the way from the immediate vicinity to the political and societal scene; and of course the time period in the history of the discipline and of the world. The same individual will generally not "research" in the same manner at 20 as at 60, at the University of Southern California or at Oxford, under Franklin D. Roosevelt or under Richard M. Nixon. Style can be influenced by fashion, that is, by a record of success. Fashion may foster rapid progress in a profitable direction, attracting a certain type of researcher, or it may turn into a fad with the opposite result. It may stimulate individuals to reach for the stars or to settle for the readily saleable, for example, pointless "space science." Apart from fashion, a certain style may be the response of a set of researchers to the specific conditions of research support in a given situation.

It seems useful to illustrate the interplay of various factors on research styles by specific examples in order to draw some lessons concerning the consequences for the researcher himself and for the research establishment as a whole. The examples should be drawn from different fields. The author, a biologist with some experience of association with physicists at various times since the 1930's, can claim little knowledge of research styles and attitudes in other fields except that gained through occasional contacts in thirty years of teaching and research in American universities.

A convenient point of departure is the contention[1] that the humanities are essentially a study of morals which can educate people for being adults -- which I take to mean that research in the humanities is an inquiry into the rules of behavior that men have devised and followed or broken or ignored, and why, and what followed.

If this interesting concept is accepted, the humane scholars are immediately removed from the ivory tower and immersed into a situation as full of normative opportunities and responsibilities as is the most engaged of social scientists. In my experience it has not been too rare to find humanists -- philosophers, historians, or literary scholars -- who draw from their subject matter the elements of a dynamic morality by which to live. In outstanding cases, the scholar may actually live a life entirely permeated by the lessons he or she derives from the pursuit of scholarship.

Is such possibility, of an ideal fusion of scholarship and practice, available at least in principle to the researcher in the natural sciences? This amounts to asking whether, besides the potential social consequences of the knowledge that emerges from the work of scientists, there is in the pursuit of their research a normative aspect that influences the practitioner's style of work and of life. Contrasted with humanities and the social sciences, which deal with the activities of human beings and their groups, the "hard sciences" are primarily consensus disciplines, in which disagreement is usually limited to alternative interpretations of well-established facts, and most theories lead to working hypotheses operationally provable or disprovable. Divergent approaches do arise from peculiarities of personal style, for example, what have been called the "gee whiz" and the "so what" attitudes. Wolfgang Pauli, one of the great physicists of this century, was supposedly the greatest "so what" physicist of them all, tending to reject any new evidence when first presented -- a characteristic often painful to his students but probably contributory to his personal style of work.

Apart from such mannerisms, a number of suggestions have been put forward concerning the relation of ethics to scientific research. The integrity in handling factual data, an integrity forced by the communal nature of the research enterprise, has been invoked[2] as imposing a habit of mutual respect and personal reliability. Alternatively, dedication to an "ethics of knowledge"[3] as a human goal in itself has been claimed to provide a touchstone and a baseline for a style of life. Yet these influences, stemming from within the subject matter of research, even if they are real, do not seem to provide a sufficiently determinant set of influences on the actual practitioner. The practice of physics as well as that of biology changes depending on external circumstances, not only in the contents of research but in the way it is carried out -- in its style. The physicists of the 1930's, whom we regarded as almost demigods, have been replaced by an equally competent but scarcely recognizable group of experts dealing with big enterprises, big programs, big machines, big money. The nature and size of their present enterprises, the large engineering components of their operations, the need for large-scale financing, the association with the sources of such financing -- dating back to World War II -- all these elements concur to "engineerize" the practice of physics. In this process, the distinction between basic research and applied or developmental research has not always remained clear and one wonders what consequences this has had on research performance.

Basic research concerns itself with knowledge and understanding, not with product. It requires competence and imagination, not efficiency. Apart from the need for financial support, to be obtained preferably through the judgment of a peer group, basic research does

not have a program to deliver specific results in a specified time. But when research becomes part of a program sponsored by a product-minded agency the style of thinking and working changes as the researcher's interests become fully identified with the practical goals of the sponsoring agency.

Till recently, biology was exempt from such conflicts. Most biological and biomedical research was either basic or related to health or to agriculture. Social consequences, such as the often unbalanced interplay between public health progress, agricultural development, population growth, and capital formation, in various parts of the world, seemed to be distantly related to research and could be written off as transient troubles resulting from introduction of technology into an imperfect world. The style of the laboratory worker hardly needed be affected. Recently, however, things have changed. Medium-big science, not quite to the scale of physics, but at a relatively substantial level, has come to biology. Some biologists have joined the jet set, and reports -- less carefully documented than articles -- are written in first-class airplane sections. At the same time, as science grows bigger anxiety mounts. Warning of the possible misuse of genetic and biochemical techniques to produce biological weaponry or human degradation are put forward, both by scientists truly concerned with providing to society an early warning of dangers that may ultimately come about and by individuals guilt-ridden by the feeling of being undeservedly sheltered in their research activities within a disturbed society. Whatever the cause, these feelings influence research style, research performance, and also the life style of the scientists in many different ways.

Not least among the anxieties of researchers is the one created by their new pattern of associations. The one with the greatest impact on research and scholarship is association with the centers of power, which in a capitalist democracy like the United States are industry and government, including the military. This association became established in World War II because the government needed scientists as well as social scientists and scholars. The relation has since continued, but has assumed a greater mutuality, each partner needing the other for its own purposes -- government work or research support. The main consequence for research style has been how the support is decided upon: government-directed research is program research, and is assigned to a presumably competent bidder, and differs from government-supported basic research.

The availability of ample research funds from government or foundations creates the entrepreneur system: the university as entrepreneur or the individual researcher as entrepreneur. A new style enters the picture: that of the Mr. X who is an expert in finding out, not who will pay for what X and X's institution <u>want</u> to do, but who needs and will pay for something that X knows how to do (or, more often, how to get done by a team of technicians). One should distinguish, of course, between an opportunistic style of entrepreneurial activity and the legitimate one, which takes advantage of societal interest in certain areas of practical knowledge -- environment, population, cancer -- to secure funds for good research valid in its own right and properly related to the supporting program. Such wise utilization of opportunities has no corrupting influence either on the content of research or on its style.

The opportunistic research style, on the contrary, may corrupt the essence of the research enterprise, irrespective of institutional setting. Insofar as the entrepreneurial system resembles a competitive production system, graduate students become employees and project directors, fund raisers. A subtle change in ethical standards follows: not necessarily a loss of integrity, but a shift from the integrity of the scholar to that of the entrepreneur. One sees signs of a subtle change taking place in biology, in which research support on a substantial basis dates only from two decades ago. For example, if someone published some good work, other scientists used to allow him to develop it alone at least for a few years. Now the eager researchers rush back from professional meetings to perform the obvious experiments that a speaker had not yet had time to do. Nothing unethical, of course -- not according to the ethics of competitive enterprise.

Going one step further, we pass from the entrepreneurial activities of scholars and their institutions to a more intimate fusion of interests between scholars and scientists and what we may call the power establishment, which in the United States consists mainly of government and its agencies, including the military-industrial machine. In this process the scholar risks being coopted willingly or unwittingly by the power machine -- a blessing or misadventure that can befall a humanist or a sociologist, a physicist or a physician, or even a biologist. At this point not only the research style but the role in society changes: from being a searcher or a user of knowledge the scholar risks becoming a manipulator of knowledge in the interest of some power group. This kind of involvement is clearly

different from the necessary and legitimate service as citizens in providing technical and professional advice. What is dangerous is becoming identified as scholars with the specific goals of certain sectors of the power structure. Often at this point confidentiality and secrecy enter the picture and with them an entirely new style -- the style of the "insider," who supposedly knows but cannot tell.

A less specialized but more common type of insider in the circles of power is drawn from the social sciences, for the very fact of the natural and legitimate concern of social scientists for public affairs. Especially in times of widespread political disagreements there becomes visible a type of social scientist who not only acts as advisor to government, but who identifies himself with specific policies of some segment of the power structure and in the development and manipulation of research techniques in the service of such policies -- perverting the very essence of research yet still claiming the privilege of an unbiased scholarship record. The Vietnam war has provided numerous examples of such associations and of a research style that claims a double standard, of academic integrity and of the raison d'état.

Social sciences are by tradition and by necessity less consensual than the natural sciences. This is reflected in the style of practitioners and in many other ways. On the positive side, the traditional concern of social scientists for socially relevant problems has contributed to create the prevailing humanitarian climate of the American university -- dedicated, serious, experimental and compassionate. On the negative side, the compulsion to justify the word "science" in the social science label has encouraged a style of work peculiarly preoccupied with the mathematical tool, sometimes with inadequate

appreciation of its limitations. More important is the unwritten tradition that success means the production of one's own "model" or theory, often very early in life. This drive has influenced the style and also the application of some social science research. Many theories in the social sciences are not really theories, that is, synthetic formulations leading to hard testable inference, but rather guesses or hypotheses suggesting possible connections and correlations. There is a danger that such hypotheses, which would require careful research to be at least to some extent validated, can become ready-made tools for manipulating delicate and even desperate human situations -- whether in the planning of scholastic programs for white or black children or in justifying the "relocation" of populations in Vietnam.

These instances, of course, are exceptions. The very participatory nature of the subject matter tends to immerse the social scientists professionally into societal affairs at many different levels. Their style is mostly that of the concerned humanitarians, and often they emerge in the role of critics and rebels[4] -- either critics of the way things happen to be going on in society at a given moment and rebels against individual episodes of injustice or, much less frequently, radical questioners of the legitimacy of the establishment.[5]

What is the influence of the relationship of researchers to the power centers of society on the way in which research itself is performed? The size of the enterprise of research in both social and natural sciences has made them dependent on governmental appropriations. These conditions of dependence may at times have made researchers and their institutions conscious of vulnerability

and therefore cautious in their personal or collective expressions, but they do not seem to have affected the content and quality of research in a fundamental way, at least in the western democracies. This reflects mainly the devices through which support has been provided -- the National Science Foundation, the National Institutes of Health, the Atomic Energy Commission in the United States (and, subject to substantial criticism, the Department of Defense); the University Grants and the various Research Councils in Great Britain; and the Centre National de la Recherche Scientifique (CNRS) in France.

The last named is an interesting experiment. Spurred by Paul Langevin and Jean Perrin, the Front Populaire Government of Léon Blum established in 1938 the CNRS. It remains, I believe, the only successful attempt in a non-socialist country to create a system for careers in research outside the teaching profession. A certain dispersion of funds, a substantial alienation of potential teachers from the desperately understaffed and overcrowded French university system -- these seemed to have been until recently the main drawbacks of the expansion of CNRS. Yet it has obviously flourished and produced some of the originally desired results, partly because most CNRS laboratories have been located within the structure of the universities, with substantial mutual benefits. A similar experiment in Italy after World War II has proved utterly unproductive, hopelessly entangled in the byzantine politique and medieval structure of the Italian university.

This brings me to the next question concerning the influence of the environment on research: the role of the university. With the coming of big science -- big humanities are still a few years away --

it is often questioned whether the university, more specifically the American university, is an optimal or even an appropriate setting for the pursuit of research. The supposed need of the researchers to be sheltered from alternative duties, the uneven quality of different universities and the mammoth size of some of them may suggest that research is more effectively done elsewhere. This suggestion should be questioned very vigorously. The coupling of research to the teaching enterprise provides irreplaceable benefits to both. Education at the college and graduate level is dwarfed if it does not have available the exposure to serious practitioners of scholarship and research. Even if these are not in the forefront of the advances in their fields, they make available the knowledge of how research is done -- of the process behind the acquisition of knowledge. There may be effective teachers who are neither scholars nor scientists; but is a student educated for life in the present world if he or she has not been exposed to the experience of research?

If the benefits that accrue from research to education are important, the reverse is even more so. Research is essentially an historical process, transmitted not only by the printed page but also by working together. The university provides a flow of young talent such as is never available to an isolated research institute. Young students new to the field can provide an invaluable stimulus to exploring areas and by-ways which the established investigator, too tired or too busy, might often neglect. The interaction with students within a university keeps the research enterprise "open," especially in times when the connections of research to its sponsoring agencies may tend to produce a closed style of functioning. In other words, the style of research is modified by the presence of students.

Apart from the question of students, the university extends another influence to research: by its traditional standards of openness and of academic freedom the university community tends to discourage elitist or partisan or profit-seeking misuses of the products of research. Academic freedom is the great invention of the university. It protects, more or less effectively, not only the right to do what a researcher wants to do (provided he obtains the means to do it), but also the right not to do what he disapproves of and to speak out against it. It protects -- again with varied efficiency -- the scholar's right to behave as he pleases within or without the university even if he offends the tastes and convictions of others -- but not their personal rights. This freedom, essential not only to research but to society as a whole, would of course be meaningless unless tied to that other much maligned institution -- academic tenure.

Academic freedom is a major determinant of style in research. Scholasticism and authority in research were defeated by academic freedom, and it was the universities that led the fight, with varying depths of conviction and varying degrees of success. It is, of course, a war that never ends: the university is an integral part of society and, like all other parts, is beset with contradictions. Within the university, therefore, freedom of research is not unlimited. This is not just a question of financial support or of opportunities to get published. Research in the university is free to the extent (or perhaps a bit more than the extent) that the university itself is free. The structure of the university, its inevitable responsiveness to the demands of the dominant social forces, its willingness to promote such forces, or submit to them, or compromise with them, or

oppose them -- whether in the name of social justice or of intellectual freedom -- influence the climate and the style and the contents of research. These days one often hears the university attacked as a submissive tool of the establishment or condemned as a politicized minion of the anti-establishment -- the strumpet of the right or the strumpet of the left. What these criticisms ignore is that, to the extent that the university is and remains a community of scholars, it must be one of the main fields in which the ethical battles of society are fought. If university research reflects by-and-large the concerns of the establishment, the university is also a place where radical intellectuals can insist on the opportunity to carry out unpopular, anti-establishment research. Within the American university, a certain amount of radical social research has long been carried out, sheltered in a minute haven provided it did not make too much trouble. The so-called politicization of universities, so bemoaned by the vocal defenders of the ivory tower, has in fact brought out the extreme smallness of the radical research enterprise and the urgent need to foster it, not as a political tool but as an integral part of the pursuit of knowledge.

The university has this to offer to the research enterprise, that it is a powerful and traditionally proud institution: probably the only institution in the history of mankind that has been molded by intellectuals for the promotion of the intellectual enterprise; not at the behest and by command of the community as client, but in the sturdy belief that the intellect best serves by promoting and developing that enterprise. Hence the university provides the natural

home for research on controversial subjects, and it is up to researchers to make optimal use of such opportunities.

In one respect the association of research with university is essential to the research enterprise: the need to educate the public about the nature and content and goals and value of research. Perhaps researchers are not the best qualified nor the most dispassionate educators in this respect. But someone has to do it. Professional writers, among them some brilliant popularizers, fail because of their misapprehensions, common to all mass media, as to what the public wants to hear. It is sufficient to read two of the best newspapers in the world, the New York Times and Le Monde, to find that the great majority of "science" stories are stories about technology. Technology, of course, is not science: it is a product of science and its practice requires scientific training, as in the education of engineers. Probably similar situations apply to the distinction between basic humanistic and social research and their applications. This confusion, nurtured by the mass media, insufficiently clarified by our school teaching practices, and encouraged by scholars themselves motivated by lack of interest or by a desire to exploit the ambiguity, is a handicap to the scholarly enterprise. Science is being accused, for example, of being the source of evils derived by misapplications of technology, over which scientists very seldom have had any measure of control. Yet scientists not only stand accused but sometimes plead guilty to lack of responsiveness to human needs and even to irresponsibility in the pursuit of their calling. In contrast, other scientists insist on the right to be indifferent to the consequences of scholarship once it ventures outside the ivory tower. A third attitude is

the claim of omnipotence for the scientific enterprise and of untold benefits to be expected -- if science is properly funded. These contrasting styles of presenting science to the public blur the issues and add to confusion.

Because of the increasing complexity of science on the one hand and the increasing gap between humanistic scholarship and mass education on the other hand, a renewed educational job is needed. The public should be told and made to understand what research is, what researchers do and what research produces, so that an informed public can judge what research itself and its products, including properly trained personnel, are worth to society. This information need not be imparted categorically or apologetically. If research is part of the human enterprise, an informed society should have the knowledge needed to judge it intelligently and press, if it so wishes, for alternative priorities. It should be possible to inform the public of the potential consequences that the fruits of science and other branches of scholarship may have when they become embodied into technology. The public needs to be made aware that science generates technology only through a complex process in which societal, nonscientific forces intervene; that the decisions as to whether a technology is developed and how it is put to use are only in minute part influenced by science. The facts that a new toxin, for example, can be stockpiled for use as a weapon or that nuclear fusion can be used in hydrogen bombs do not indict the pursuit of microbiology or nuclear physics as branches of weaponeering. Neither does this line of reasoning exempt, however, researchers from the responsibility of making themselves aware

of the possible applications of their work and to educate the public according to their own judgment.

Legitimacy is claimed for research on the basis both of its contributions to the intellectual enterprise of humanity and of the material or moral benefits that may accrue from the knowledge produced by research. This legitimacy needs to be asserted even more at a time when disappointment with the failure of certain expectations of progress and with some misuses of the fruits of science have turned young people all over the world against rationality itself as a source of valid knowledge. The rationality embodied in research remains most probably the foundation upon which mankind can strive to build its uncertain future. But the pursuit of research may well have to be accompanied by more humble claims and by greater sensitivity and responsiveness to the needs of society to understand, choose, and evaluate the social contributions of the research enterprise.

FOOTNOTES

[1] Eric Weil, "Financing the Humanities," Daedalus (this issue).

[2] See, for example, Jacob Bronowski, Science and Human Values (New York, Harper and Row, 1956).

[3] Jacques Monod, Le Hasard et la Nécessité (Paris, Seuil, 1970).

[4] Seymour Martin Lipset and Richard B. Dobson, "The Intellectual as Critic and Rebel: With Special Reference to the United States and the Soviet Union," Daedalus (Summer, 1972), 137-198.

[5] Jill Conway, "Intellectuals in America: Varieties of Accommodation and Conflict," Daedalus (Summer, 1972) 199-205.